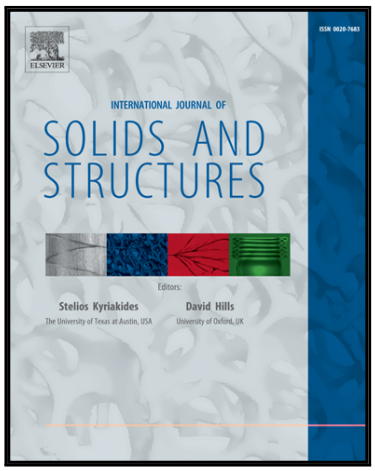

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Numerical modelling of the mechanical response of cellular solids made from sintered Titanium powders

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ABSTRACT

Two algorithms are developed to generate virtual microstructures of Titanium foams of medium relative density, in the range 0.37 – 0.48; one of the algorithms captures the effect of pore shape and size distribution, while the other algorithm only accounts for the relative density of the material. Foams are modelled as two-phase composites consisting of a solid material and voids; the elasto-plastic and damage response of the parent material is deduced from its measured mechanical responses in tension and compression, while the material occupying the voids is assigned a plastically compressible constitutive response, to mimic the effects of pore collapse and subsequent self-contact. Finite Element (FE) simulations are conducted to predict the measured macroscopic material response in uniaxial tension and compression, as well as in pure shear; a mesh convergence study is performed and the minimum RVE size is determined. The simulations are found in good agreement with measurements and can predict accurately and effectively the material's mechanical response up to large strains, as well as the scaling of mechanical properties with relative density.

Keywords: Titanium, foam, FEM, damage, plasticity, stochastic.

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